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Barremian ammonite zonation in the Carpathian area

By

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With 1 table

ABSTRACT

The Romanian rich ammonitic material collected from the Barremian stage interval allowed to propose a more detailed zonal scheme, as follows:

Lower Barremian:

1. *Pseudothurmannia picteti* zone (range zone), with *P. pseudomalbosi* and *P. belimelensis* only in its lower part and with *P. angulicostata* and *P. catulloi* in its upper part.
2. *Holcodiscus caillaudianus* zone (range zone), comprising two subzones:
   a) with *Pulchellia changarnieri*
   b) with *Pulchellia compressissima,*
   the latter having in its whole interval numerous *Leptoceras* and, at the top, a level with *Torcapella suessi.*

Upper Barremian

3. *Silesites seranonis* zone (partial range zone) with four subzones:
   a) with *Heinzia provincialis,* having a thin level with *Ancyloceras mojsisovici* in its upper part
   b) with "*Crioceratites*" ex gr. *barremense-orbignyi*
   c) with *Imerites giraudi* and *Eristavia dichotoma*
   d) unnamed, at the top of the Barremian interval (but having representatives of *Parancyloceras* ? sp. as the only possible index fossil).

The *Pseudothurmannia picteti* zone is considered to belong to the Barremian stage because its base is an important evolutionary threshold by the first apparition of the genera *Pseudothurmannia, Paraspiticeras* and *Psilotissotia.*

The Barremian-Aptian boundary is accepted to be at the level where, together with the last specimens of *Silesites seranonis,* the appearance of *Pseudohaploceras matheroni* and also of the first representatives of the genus *Neohibolites* was recorded.

KURZFASSUNG

Reiche Ammonitenfunde im Barreme Rumäniens erlauben den Vorschlag einer detaillierten Zonengliederung:

Unter-Barreme:

1. *Pseudothurmannia picteti* Zone (Range-Zone) mit *P. pseudomalbosi* und *P. belimelensis* nur im unteren Teil und mit *P. angulicostata* und *P. catulloi* im oberen Teil.
2. *Holcodiscus caillaudianus* Zone (Range-Zone), mit 2 Subzonen:
   a) mit *Pulchellia changarnieri;*
   b) mit *Pulchellia compressissima;*
   letztere enthält zahlreiche Vertreter von *Leptoceras* und im oberen Teil eine Lage mit *Torcapella suessi.*

Ober-Barreme:

3. *Silesites seranonis* Zone (Partial Range Zone) mit 4 Subzonen:
   a) mit *Heinzia provincialis,* im oberen Teil mit einer dünnen Lage mit *Ancyloceras mojsisovici;*
   b) mit "*Crioceratites*" ex gr. *barremense-orbignyi;*
   c) mit *Imerites giraudi* und *Eristavia dichotoma;*
   d) unbenannt, im obersten Teil des Barreme, mit Vertretern von *Parancyloceras?* sp. als den einzigen möglichen Indexfossilien.

Die *Pseudothurmannia picteti* Zone wird in die Barreme-Stufe gestellt, da sich im unteren Teil dieser Zone wichtige Entwicklungsschritte vollziehen durch das Ersterscheinen der Gattungen *Pseudothurmannia, Paraspiticeras* und *Psilotissotia.*

Die Grenze Barreme-Apt wird unter der Lage mit den letzten Formen von *Silesites seranonis,* dem Erscheinen von *Pseudohaploceras matheroni* und den ersten Vertretern der Gattung *Neohibolites* fixiert.

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INTRODUCTION

The Romanian outcrops of the Lower Cretaceous deposits are the richest in ammonites within the Barremian stage interval. The main fossiliferous areas at this level are already well known: Dîmbovicioara Couloir in the southern part of the East Carpathians and Svinitsa region, on the Danube, in Banat (SW Romania). Besides them, there are some others in the inner part of the Carpathian flysh: Prahova, Doftana and Tîrlung valleys, Baraolt Mts., etc., where the Barremian deposits offered also useful data for a discussion about the ammonite assemblages at various levels of this stage.

Some paleontological or biostratigraphical studies about the Barremian deposits from these regions are published: Tietze (1872), Simionescu (1898), Vadasz (1911), Kiss (1911), Oncescu (1943), Răileanu (1953), Stefănescu, Avram & Stefănescu (1965), Patrulius (1952, 1969), Kusko & Savu (1970), Patrulius & Avram (1976), Avram (1976, 1980); other ones are now in preparation.

These studies, especially the recent ones, allowed to propose a more detailed ammonite zonation of the Barremian stage, partly different from the others published in the last years (Busnardo, 1965; Dimitrova, 1966; Kotetishvili, 1970; Breskovski, 1973; Vermeulen, 1974; Drushchits & Gorbachik, 1978; Vašiček, 1979).

1. THE LOWER AND UPPER BOUNDARIES OF THE BARREMIAN STAGE

In spite of the general acception of the Hauterivian-Barremian boundary at the top of the *Pseudothurmannia* zone, there are some recent authors (Drushchits, 1960; Patrulius, 1969; Breskovski, 1973; Patrulius & Avram, 1976, Avram, 1976 and, partly, Lapeyre & Thomel, 1974) which include this zone in Barremian, thus coming back to the first deffinition of the stage (Coquand, 1861).

We consider also this point of view to be more acceptable, based on two facts:

1. The first apparition at this level of the genera *Pseudothurmannia*, *Psilotissotia* and *Paraspiticeras* (first representatives of the family Hemihoplitidae, Pulchelliidae and Douvilleiceratidae), then on a remarquable evolutionary threshold in the ammonite evolution.
2. The existence of the typical specimens of *Crioceratites emerici* Lév. (one of the first index fossils of the Lower Barremian) below the first beds with *Pseudothurmannia*.

It is to notice that the same association: *Pseudothurmannia – Paraspiticeras – Crioceratites emerici* was found in Bulgaria by Breskovski (1973) and that Lapeyre & Thomel (1974) recognised in the beds with *Pseudothurmannia angulicostata* (d'Orb.) also *Crioceratites emerici* and *Psilotissotia favrei* (Ooster).

The upper boundary of the Barremian stage is very difficult to establish in Romania because at this level the ammonitic assemblage is very poor. In these conditions we consider this boundary as in France (Busnardo, 1965; Fabre-Taxy et al., 1965; Moullade, 1966), immediately under the first level with *Pseudohaploceras matheroni* (d'Orb.) and *Prochelonic eras* spp. Between this level and that with the first *Deshayesites* there is (as in France, too), a relatively thick sequence of strata wherein the only evolutionary feature is the first apparition of the genus *Neohibolites* (fide Patrulius & Avram, 1976).

2. THE BARREMIAN AMMONITE ZONATION IN ROMANIA

The here below proposed zonation is mainly based by the data obtained in Dîmbovicioara Couloir (Patrulius & Avram, 1976, revised) and Svinitsa region (Avram, 1976, revised), where the rich ammonite fauna was collected bed by bed through the whole Barremian set of deposits. Three zones, two of them devided into 2 and, respectively, 4 subzones were identified, as follows:

1. *Pseudothurmannia picteti* zone (range zone), in Svinitsa region characterised by a rich assemblage, has *Pseudothurmannia picteti* Sarkar within its whole interval, *Pseudothurmannia* cf. *pseudomalbosi* (Sar. & Schönd.) and *P.* cf. *belimelensis* Dimitrova only in its lower part, and *Pseudothurmannia* cf. *angulicostata* (d'Orb.), *P. catulloi* (Parona), *P. biassalensis* Dimitrova only in its upper part. In Dîmbovicioara Couloir we recognised *Pseudothurmannia* cf. *picteti*, *P.* aff. *mortilleti* (Pict. & Lor.) and *P. grandis* Busn., without any possibility for a subzonation. The other species of the zone are: *Hamulina astieriana* d'Orb., *H.* cf. *alpina* d'Orb., *Psilotissotia favrei* (Ooster), *Paraspiticeras guerinianum* (d'Orb.), *P. pachycyclum* (Uhlig), many *Phyllopachyceras* spp., *Protetragonites crebrisulcatus* (Uhlig), *Melchiorites* spp., etc. and, only at the base, *Acrioceras seringei* (Astier) and *Paraspinoceras pulcherrimum* (d'Orb.).

2. *Holcodiscus caillaudianus* zone (range zone) is comprising the largest part of the Lower Barremian and within its interval there are two subzones:

a) *Pulchellia changarnieri* subzone, with *Lytoceras puezanum* Haug, *Hamulina astieriana* , *H.* cf. *alpina*, *Crioceratites* ex gr. *emerici* Lev., *Spitidiscus vandeckii* (d'Orb.), *S. oosteri* (Sar. & Schönd.), *Holcodiscus caillaudianus* (d'Orb.), *Psilotissotia favrei* (its last apparition, only in Svinitsa), *Pulchellia changarnieri* Sayn, *Subpulchellia sauvageaui* (Herm.), *Nicklesia* aff. *karsteni* (Uhlig), *Silesites ? concretus* Kar.

b) *Pulchellia compressissima* subzone is comprising also *Holcodiscus caillaudianus* besides *Leptoceras* spp. (some new

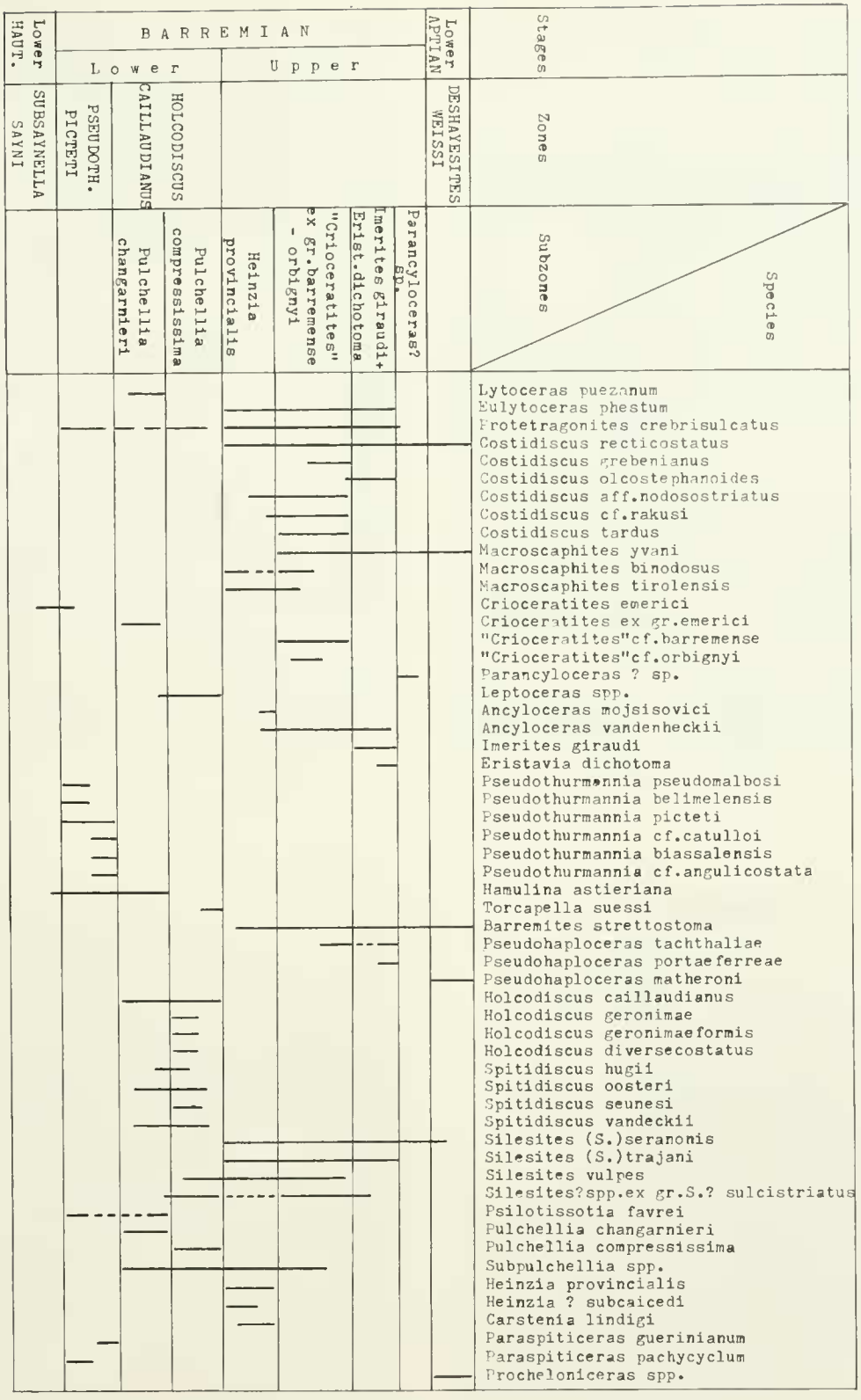

Table 1. Ranges of the main Barremian ammonite species in the Carpathian area.

species and *L. pumilum* Uhlig, *L. subtile* Uhlig), *Eoleptoceras (E.) wrighti* Man., *Hemibaculites* aff. *zaharievae* Man., *Anahamulina* cf. *subcylindrica* (d'Orb.), *A.* cf. *silesiaca* (Uhlig), *Dissimilites trinodosus* (d'Orb.), *Melchiorites* aff. *blayaci* (Kil.), *M. tenuicinctus* (Sar. & Schönd.), *M.* aff. *fallaciosus* (Kil.), *M. cassidoides* (Uhlig), *M. uhligi* (Haug), *M.* aff. *rumanum* (Kil.), *Holcodiscus perezianus* (d'Orb.), *H. geronimae* (Hermite), *H. geronimaeformis* Tzankov, *H. diversecostatus* (Coq.), *H.* cf. *gastaldinus* Uhlig (non d'Orb.), *H. ziczac* Kar., *Spitidiscus oosteri* (Sar. & Schönd.), *S. seunesi* (Kil.), *S.* cf. *vandeckii* (d'Orb.), *Silesites vulpes* (Coq.) which appears in this interval, *Silesites* ? ex gr. *sulcistriatus* Kar.-*tenuis* Kar., *Pulchellia compressissima* (d'Orb.), *Subpulchellia* sp. and *Phyllopachyceras* spp., *Hol-*

cophylloceras spp. *Lytoceras* spp., *Protetragonites crebrisulcatus* (Uhl.), etc. Near the top of this assemblage sequence of strata, in Dîmbovicioara Couloir is located a level with many specimens of *Torcapella suessi* (Sim.) (Patrulius & Avram, 1976).

3. *Silesites seranonis* zone (Partial range zone, because the index species occurs also above its top, in the beds with *Pseudohaploceras matheroni* (d'Orb.), *Prochelonicera* spp., *Neohibolites* spp. and even with *Deshayesites*). This zone is divisible in four subzones, as follows:

a) *Heinzia provincialis* subzone, characterised by the pulchelliids of the *Heinzia* group: *Heinzia provincialis* (d'Orb.), *H. galeatoides* (Karst.), *H.? subcaicedi* (Sayn), *H. (Carstenia) lindigi* (Karst.) and also by *Eulytoceras phestum* (Math.) (from the base), *Costidiscus recticostatus* (d'Orb.) (from the base), *C.* aff. *nodosostriatus* Uhlig, *Macroscaphites tirolensis* Uhlig, *Ancyloceras vandenheckii* Astier, *A. mojsisovici* Haug (in its upper part, only), *Anahamulina* cf. *subcylindrica* (d'Orb.), *A.* ? cf. *silesiaca* (Uhlig), *Barremites strettostoma* (Uhlig), *Melchiorites* aff. *nabdalsa* (Coq.), *Silesites (S.) seranonis* (d'Orb.) (from the base), *S. (S.) trajani* (Tietze), *S. vulpes* (Coq.) and, at the top, *Lithancylus* cf. *tirolensis* Casey, besides *Phyllopachyceras*, *Holcophylloceras*, *Protetragonites*, etc.

b) "*Crioceratites*" ex gr. *barremense-orbignyi* subzone, very well characterised in Svinitsa region contains *Costidiscus recticostatus* (d'Orb.), *C.* cf. *rakusi* Uhlig, *C. tardus* Avram, *C.* aff. *nodosostriatus* Uhlig, *C. grebenianus* (Tietze), *Macroscaphites yvani* (Puzos), *M. binodosus* Uhlig, *M. tirolensis* Uhlig, *Anahamulina boutini* (Coq.) Math., *A.* ? cf. *silesiaca* (Uhlig), *Ancyloceras vandenheckii* Ast., *Dissimilites trinodosus* (d'Orb.), "*Crioceratites*" cf. *barremense* (Kil.), "*C.*" cf. *orbignyi* (Math.), *Barremites strettostoma*, *Melchiorites* aff. *nabdalsa*, *M.* ex gr. *melchioris* (Tietze), *Pseudohaploceras tachthaliae* (Tietze), *Silesites (S.) seranonis*, *S. (S.) trajani*, *S. vulpes*, *S.* ? ex gr. *sulcistriatus-tenuis*, *Subpulchellia* sp. and also numerous *Phyllopachyceras*, *Holcophylloceras*, *Hypophylloceras* and *Lytoceras*, *Eulytoceras*, *Protetragonites*.

c) *Imerites giraudi* and *Eristavia dichotoma* subzone contains a relative homogenous assemblage in both the Svinitsa and Dîmbovicioara regions: *Costidiscus recticostatus*, *C. olcostephanoides* Uhlig, *Macroscaphites yvani*, *Anahamulina boutini*, *Dissimilites* sp., *Ancyloceras* cf. *vandenheckii*, *Imerites giraudi* (Kil.), *I. giraudi multicostatus* Tovbina, *Eristavia dichotoma* (Eristavi), *Argvethites* cf. *lashensis* Rouch., *Melchiorites* ex gr. *melchioris*, *Pseudohaploceras tachthaliae* (Tietze), *P. portaeferreae* (Tietze) and various *Phyllopachyceras*, *Holcophylloceras*, *Eulytoceras*, *Protetragonites*, etc.

d) The last sequence, some 10 m thick, situated at the top of the Upper Barremian offered a very poor ammonite assemblage, from which only *Parancyloceras* ? sp. is more interesting as a possible index species (a species with lateral view of "*Leptoceras*" *puzosianum* d'Orb. but with tabulate ventrum and ventrolateral small tubercles, like *Parancyloceras bidentatum* [v. Koenen]).

3. ZONAL ASSIGNEMENTS OF THE MOST FOSSILIFEROUS BARREMIAN

EAST CARPATHIAN FLYSH DEPOSITS

There are only three lithological units in the East Carpathian flysh which offered till now numerous ammonites of Barremian age: Comarnic formation and the lower member of the Piscu cu Brazi formation, in the southern part of the Carpathian Bend, and also the lower member of the Bistra formation, in the northern part of the Carpathian Bend.

The Comarnic formation (Mrazek, Popescu-Voitesti & Macovei, 1912, emend Murgeanu, 1934) is containing numerous Barremian ammonites in the Prahova, Doftana and Tîrlung valleys. Its lower member (Valea Muşiţei member – Avram, 1980) is comprising Upper Hauterivian and Lower Barremian ammonitic assemblages, the latter consisting in *Eoleptoceras (E.)* cf. *parvulum* (Uhlig), *Reboulites* aff. *gouxi* (Sayn), *Psilotissotia malladae* (Nicklès), etc., on the Doftana valley, and in *Lytoceras densifimbriatum* Uhlig, *Leptoceras* sp., *Eoleptoceras (E.)* cf. *parvulum* (Uhlig), *Karsteniceras* aff. *beyrichi* (Karst.), *Holcodiscus* sp. aff. *H. nicklesi* Kar., *Pulchellia* aff. *changarnieri* Sayn, *P. schlumbergeri* Nicklès, *Nicklesia* aff. *pulchella* (d'Orb.), *Melchiorites* ? cf. *compsense* (Kil.), on the Tîrlung valley (Avram, 1976, 1980). Almost all these species are characteristic of the upper subzone of the *Holcodiscus caillaudianus* zone; only *Psilotissotia malladae* and *Pulchellia* aff. *changarnieri* are arguments for the presence of its lower subzone.

The upper member of the Comarnic formation (Plaiul Sirnei member – Avram, 1980) contains in its lowermost level, which is lithologicaly very characteristic, an ammonitic assemblage proper to the last subzone of the Lower Barremian: *Karsteniceras beyrichi*, *Anahamulina fumisugia* (Hoh.) Uhlig, *Barremites difficilis* (d'Orb.), *Silesites vulpes* (Coq.), *Pulchellia* cf. *compressissima* (d.'Orb.), *P. schlumbergeri*, etc., in the Prahova valley (Stefănescu, Avram & Stefănescu, 1965; Patrulius, 1969) and *Karsteniceras* aff. *beyrichi*, *Moutoniceras* sp., *Dissimilites dissimilis* (d'Orb.), *Holcodiscus* sp., *Silesites* cf. *vulpes*, *Pulchellia multicostata* (Riedel), *Subpulchellia sauvageaui* (Hermite), in the Doftana valley (Avram, 1976, 1980).

The same level, with marly calcareous shalles, offered a transitional assemblage between Lower and Upper Barremian ammonite assemblages, on the watershad between Ialomitsa and Prahova valleys: *Eulytoceras phestum* (Math.), *E. raricinctum* (Uhlig), *Leptoceras subtile* Uhlig, *Anahamulina* sp. ex gr. *A. fumisugia* (Hoh.) Uhlig, *Ptychoceras* sp., *Acrioceras* sp., *Barremites difficilis* (d'Orb.) (Patrulius, 1952, 1969) and *Macroscaphites binodosus* Uhlig (Stefănescu, Avram & Stefănescu, 1965).

Upper Barremian ammonites of the same member are rare and do not permit to identify their zonal assignement: *Holcophylloceras guettardi* (Rasp.), *Macroscaphites yvani* (Puzos),

in the Ialomitsa and Prahova valleys (Stefănescu, Avram & Stefănescu, 1965; Patrulius, 1969), *Acrioceras silesiacum* (Uhlig), *A.* cf. *karsteni* (Hoh.) Uhlig and *Pseudohaploceras* sp. aff. *P. liptoviense* (Uhlig) in the Doftana valley (Avram, 1976, 1980).

The lower part of the Piscu cu Brazi formation: Purcăreni member (Gräf, 1969, 1975, emend Avram, 1980) from the Tîrlungu basin is also comprising some rich Barremian ammonitic faunas: *Leptoceras pumilum* Uhlig, *L. subtile* Uhlig, *Karsteniceras* aff. *beyrichi*, *Holcodiscus caillaudianus* (d'Orb.), *H. perezianus* (d'Orb.), *H. gastaldinus* Uhlig (non d'Orb.), *Silesites* cf. *vulpes*, in the northern part of the Tîrlungu basin; *Barremites* aff. *subdifficilis* (Kar.), *Pseudohaploceras* sp. aff. *P. douvillei* (Fallot), *Silesites seranonis* (d'Orb.) on the watershad between Doftana and Tîrlungu bassins. The former assemblage shows the last subzone of the Lower Barremian; the later belongs to the Upper Barremian, without any possibility for a subzonal integration.

The "flyshoid horizon" (Kusko & Savu, 1970) of the Bistra formation (Macovei & Atanasiu, 1934) offered in the Baraolt Mts. a very rich ammonite fauna, identified for the first time by Vadasz (1911) and Kiss (1911). This fauna, strictly located in the *Pulchellia compressissima* subzone is consisting of: *Leptoceras subtile*, *L. pumilum*, *L.* cf. *barnaense* (Rieber), *Eoleptoceras (E.)* aff. *fragile* (Uhlig), *Anahamulina* aff. *hoheneggeri* (Uhlig), *Acrioceras* sp. aff. *A. tabarelli* (Astier), *Crioceratites* aff. *emerici* Lev., *Barremites* cf. *difficilis*, *Melchiorites* sp. aff. *M. tenuicinctus* (Sar. & Schönd.), *Holcodiscus* cf. *caillaudianus*, *H. gastaldinus*, *H. irregularis* Tzankov, *H.* aff. *nodosus* Kar., *Spitidiscus hugii* (Ooster), *S.* cf. *oosteri* (Sar. & Schönd.), *S. andrussowi* (Kar.), *Silesites* sp. ex gr. *S. vulpes*, *Silesites* ? sp. aff. *S.? sulcistriatus* Kar.-*S.? tenuis* Kar., *Pulchellia compressissima* (d'Orb.), *Subpulchellia sauvageaui* (Hermite), besides *Phyllopachyceras* spp., *Holcophylloceras* sp., *Protetragonites* sp., etc. It is remarquable also, the presence in this assemblage of some specimens of *Paraspinoceras* (?) with a very thin ribbing of the proversum, reminding *Paraspinoceras pulcherrimum* (d'Orb.) (Avram & Kusko, 1982). The upper part of the same formation offered till now only a few Upper Barremian-Lower Aptian species: *Ptychoceras puzosianum* d'Orb., *Macroscaphites yvani* (Puzos), unsufficient for the zonal record of its level of prelevation (Macovei, 1954; Avram & Kusko, 1982).

As a conclusion of the above inventory, it is necessary to emphasise that the ammonite assemblages from the Barremian flysh deposits are rich only at the level of *Pulchellia compressissima* subzone, at the top of the Lower Barremian. This is the level where, above the lower member of the Comarnic formation there were some regional changes in the lithology of the Barremian deposits: from the upper member of the Comarnic formation northward, to the lower member of the Piscu cu Brazi formation and to the lower member of the Bistra formation.

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